

ADDENDUM TO THE FREMONT-PINEKNOT EAST RESTORATION PROJECT ENVIRONMENTAL ASSESSMENT

This addendum is provided for the Fremont-Pineknott East Restoration Project Environmental Assessment (EA) and to disclose results of the 36 C.F.R. § 218 – Project-Level Pre-Decisional Administrative Review Process, Subparts A 2014 and B. During the objection process, three objections were received and reviewed by Objection Reviewing Officer William B. Nightingale (Project File, W. B. Nightingale, Letter to Objectors, Correspondence, 2015, July 23). Reviewing Officer Nightingale's Letter to Objectors included instruction to the Responsible Official, Timothy W. Bond, to clarify how the Simple Approach Smoke Estimation Model (SASEM) and the First Order Fire Effects Model (FOFEM) were used and discussed in the analysis and decision for the Fremont-Pineknott East Restoration Project EA, with the goal of improving public understanding regarding the broader process of parameter development and prescribed fire implementation. The addendum has been prepared to comply with the Objection Reviewing Officer's instructions.

The following sections of the original EA discussed the Simple Approach Smoke Estimation Model (SASEM) and the First Order Fire Effects Model (FOFEM) models and how they were used, prescribed fire prescriptions and implementation. These sections have been modified to clarify and better explain the information to improve public understanding.

CHAPTER 3 - ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

FIRE/FUELS EFFECTS

Methodology:

The predicted *smoke effects* for this project were evaluated using the Simple Approach Smoke Estimation Model (SASEM) and the First Order Fire Effects Model (FOFEM). SASEM is a screening and smoke dispersion model designed to predict ground-level particulate matter and visibility impacts from smoke produced by prescribed fire. SASEM is a conservative screening model, and it tends to over-estimate impacts. If emissions higher than National Ambient Air Quality Standards are not predicted by SASEM, it is unlikely that they will occur during prescribed fire implementation. FOFEM is designed to make quantitative predictions of fire effects.

DIRECT AND INDIRECT EFFECTS ON FIRE/FUELS

ALTERNATIVE 2 – PROPOSED ACTION

Smoke Effects: Under Alternative 2 – Proposed Action predicted smoke effects were evaluated using the Simple Approach Smoke Estimation Model (SASEM) and the First Order Fire Effects Model (FOFEM). The SASEM and FOFEM models provide smoke emission concentration estimates or metrics, which may contribute to the development of prescribed fire prescription parameters. Prescribed fire prescription parameters limit and focus the range of fire behavior, helping ensure that prescribed fires only occur during appropriate environmental conditions.

Results from SASEM and FOFEM model analysis for the proposed prescribed fires do not predict values that would exceed the National Ambient Air Quality Standard (NAAQS). Results from SASEM and FOFEM analysis do not predict values exceeding $35 \mu\text{g}/\text{m}^3$ for any prescribed fire conducted under conditions described in this EA. The threshold measure in $\mu\text{g}/\text{m}^3$ refers to the concentration of an air pollutant (e.g., ozone) in micrograms (one-millionth of a gram) per cubic meter of air. The threshold for the 24-hr primary $\text{PM}_{2.5}$ National Ambient Air Quality Standard (NAAQS) is $35 \mu\text{g}/\text{m}^3$.

Comparing SASEM and FOFEM results values to the National Ambient Air Quality Standard (NAAQS) 24-hr primary $\text{PM}_{2.5}$ threshold is useful for determining areas where additional design features may be warranted to reduce or mitigate effects of smoke. No additional design features would be needed for prescribed fires as analyzed in this EA.

Actual NAAQS violations occur only when a federal reference monitor is used, and the value exceeding the threshold is the 3-year average of the 98th percentile of the 24-hr concentrations.

No visibility impacts are expected for the Mingo Wilderness Area, a Class 1 Federal Area (under 40 CFR Part 81) where visibility is an important value and is not be impaired per 42 USC §7491. The Mingo Wilderness Area is located 80 kilometers east of the project area. Visibility protection for the Mingo Wilderness Area Class I Federal Area would be maintained through smoke management prescription parameters identified in the project file.

There is some potential for short-range and short-duration visual impacts to adjacent roads related to prescribed fire implementation. These impacts are mitigated with prescribed fire prescription parameters for meeting smoke management objectives and with on-site traffic control and or law enforcement as necessary.

With the SASEM model, downwind smoke receptors are entered as model inputs to predict smoke impacts to these downwind receptors. Prescribed fire prescription parameters are adjusted to minimize smoke impacts to these downwind receptors such as highways, schools, and communities.

Smoke from wildfires and both private and agency (e.g., Missouri Department of Conservation, Forest Service, and National Park Service) prescribed fire is common across the district. Public complaints of nuisance smoke occur occasionally. Most public interest related to smoke has been calls from the public that have seen smoke and reported it thinking it was a wildfire.

The forest seeks to inform the public of prescribed fires. Adjacent private landowners are notified prior to implementing any prescribed fire. The locations of prescribed fire areas are

identified on the Mark Twain National Forest website. Public notification includes radio announcements, and phone calls to adjacent landowners, area law enforcement, and others.

Pages 44 and 45

CUMULATIVE EFFECTS ON FIRE/FUELS

The predicted direct and indirect smoke effects for this project were evaluated using the Simple Approach Smoke Estimation Model (SASEM) and the First Order Fire Effects Model (FOFEM). Results from these models suggest that smoke emissions from this project should not endanger public health.

No visibility impacts are expected for the Mingo Wilderness Area, a Class 1 Federal Area (under 40 CFR Part 81) where visibility is an important value and is not be impaired per 42 USC §7491. The Mingo Wilderness Area is located 80 kilometers east of the project area. Visibility protection for the Mingo Wilderness Area Class I Federal Area would be maintained through smoke management prescription parameters identified in the project file.

Cumulative effects from smoke are not expected. No agency (e.g., Missouri Department of Conservation, Forest Service, and National Park Service) or private prescribed fires are likely to occur of sufficient size or within close proximity to the prescribed fire area on a given day when prescribed fire would be implemented. Prescribed fire prescription parameters specify needed transport wind parameters to mix smoke columns in the upper atmosphere and transport them from the prescribed fire area.

Page 45

APPENDIX C - RESULTS OF 30-DAY COMMENT PERIOD AND FOREST SERVICE RESPONSE TO COMMENTS

PUBLIC CONCERNS IDENTIFIED IN PUBLIC COMMENTS

VEGETATION MANAGEMENT

PC 24 - D Themes—Additional Response to Human Health Impacts.

The effects of prescribed fire and smoke were analyzed in the environmental assessment (EA, pp. 36 - 51). Predicted smoke effects were evaluated using the Simple Approach Smoke Estimation Model (SASEM) and the First Order Fire Effects Model (FOFEM). The SASEM and FOFEM models provide smoke emission concentration estimates or metrics, which may contribute to the development of prescribed fire prescription parameters. Prescribed fire prescription parameters limit and focus the range of fire behavior, helping ensure that prescribed fires only occur during appropriate environmental conditions.

Page 279

OTHER CORRECTIONS AND CLARIFICATIONS

In the course of his review, the Objection Reviewing Officer identified some references and information in the Air Quality section of the EA that were not up to date. Specifically, the analysis referenced the Clean Air Act of 1963, but should have referenced the Clean Air Act of 1990. The analysis also referenced an old Missouri State Rule regarding open burning in the State. That citation should have been Missouri Code of State Regulations (2015) *10 CSR 10-6.045 Open Burning Requirements* instead of State Rule 10 CSR 10-3.030, 4(c.7). And finally, the most recent report from the US Environmental Protection Agency of non-attainment areas was not included in the document.

The changes between the references cited and the updated versions are not substantive, and using the updated versions does not change the basic conclusions of the analysis presented in the EA. While not part of the Reviewing Officer's instructions, I have chosen to include the corrected paragraphs with those updated citations in this document. I have also modified and clarified some of those paragraphs so that the information is presented more clearly.

AIR QUALITY

Affected Environments

The Clean Air Act of 1990 requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for pollutants that are deemed harmful to public health and the environment. The Clean Air Act presents two types of NAAQS: primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly, while secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

EPA identified NAAQS for six principal pollutants, which are called "criteria" pollutants. These pollutants include carbon monoxide (CO), particulate matter (PM_{2.5} and PM₁₀), ozone (O₃), nitrogen dioxide (NO₂), sulfur dioxide (SO₂) and lead (Pb). The pollutant of most concern in smoke from fire is fine particulate matter (PM), both PM₁₀ and PM_{2.5}. Past studies of human health with regard to the effects of particulate matter have shown that fine particles, especially PM_{2.5}, are largely responsible for health effects (Dochery et. al., 1993).

Table 10. Human Health Concerns Based on PM_{2.5} Smoke Emissions displays air quality conditions, air quality index values, and revised breakpoint values in micrograms (one-millionth of a gram) per cubic meter of air (µg/m³).

Table 10. Human Health Concerns based on PM_{2.5} Smoke Emissions

Air Quality Condition	Air Quality Index Values	Revised Breakpoints PM _{2.5} (µg/m ³ , 24-hour annual average)
Good	0 - 50	0.0 – 12.0
Moderate	51 - 100	12.1 – 35.4
Unhealthy for Sensitive Groups	101 – 150	35.5 – 55.4
Unhealthy	151 – 200	55.5 – 150.4
Very Unhealthy	201 – 300	150.5 – 250.4
Hazardous	301 – 400	250.5 – 350.4
	401 – 500	350.5 – 500

Adapted from U.S. Environmental Protection Agency (2014a, n.d.), 40 CFR Part 58, Appendix G, Table 2 (2013).

AirNow (2015) and the EPA (U.S. Environmental Protection Agency, 2014b) provide explanations of the air quality index. Air quality conditions range from Good to Hazardous. The air quality index (AQI) ranges from 0-500. AQI values below 100 are considered Good to satisfactory. Higher AQI values reflect higher levels air pollution. AQI values above 100 are associated with health concerns, and become of greater concern as the AQI levels become higher. Air quality is considered to be unhealthy at first for sensitive groups of people, then for everyone as AQI values get higher. The AQI focuses on health effects that you may experience within a few hours or days after breathing polluted air.

The revised breakpoint values display the range of micrograms (one-millionth of a gram) per cubic meter of air (µg/m³) that are associated with a given air quality condition and air quality index value range. As explained in the Smoke Effects for Alternative 2 – Proposed Action Direct and Indirect Effects on Fire/Fuels, SASEM and FOFEM model analysis for prescribed fires predict values below the 35 µg/m³ threshold measure for the 24-hr primary PM_{2.5} National Ambient Air Quality Standard (NAAQS) is 35 µg/m³. Smoke emissions would be primarily limited to the immediate prescribed fire area.

Page 45 and 46

Areas of the country where air pollution levels persistently exceed the national ambient air quality standards may be designated "nonattainment" (U.S. Environmental Protection Agency, 2015a). EPA defines non-attainment areas, as "a geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards" (U.S. Environmental Protection Agency, 2013).

The nearest non-attainment area to the Fremont-Pineknott East Restoration Project is St. Louis, Missouri, including St. Louis, Franklin, St. Charles, and Jefferson Counties surrounding the city as indicated by a review of EPA's AirData system and maps (U.S. Environmental Protection Agency, 2015b, 2014c). These nonattainment areas are approximately 150 miles to the northeast of the project area and would not be impacted by smoke from prescribed fire in this project.

The Fremont-Pineknott East Restoration Project area is designated as attainment for all six NAAQS criteria pollutants (U.S. Environmental Protection Agency, 2015b, 2014c). EPA defines attainment area as "a geographic area in which levels of a criteria air pollutant meets the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant" (Environmental Protection Agency, 2013).

The Missouri Code of State Regulations (2015) *10 CSR 10-6.045 Open Burning Requirements* allows open burning without a permit, specifically prescribed fires, set for natural resource management purposes. The Fremont-Pineknott East Restoration Project complies with all federal, state, and local regulations relating to air quality, as well as the 2005 Forest Plan.

The main sources of carbon monoxide in the area are from combustion engines associated with vehicles, and outdoor burning. The main sources of PM₁₀ and PM_{2.5} are from local wood burning home units, debris and broadcast burning on private, state and federal lands, wildland fires, fugitive dust from un-surfaced roads and other agricultural activities. There are no primary sources of ozone in the proposed area, but activities such as burning can produce some of the precursors to ozone, such as nitrogen oxides and organic carbon.

Pages 47 and 48

DIRECT AND INDIRECT EFFECTS ON AIR QUALITY

Smoke can have an impact on how far and how clearly we can see on a highway or in viewing scenery. Fine particles in smoke are known to be able to scatter and absorb light, which can reduce visibility. There is some potential for short-range and short-duration visual impacts to adjacent roads related to prescribed fire implementation. These impacts are mitigated with prescribed fire prescription parameters for meeting smoke management objectives and with onsite traffic control or law enforcement as necessary.

Based on the location from the proposed project and prescribed wind directions for implementation of a prescribed fire, visibility would not likely be impacted at the Mingo Wilderness Area or Hercules Glades Wilderness Area. (Both wilderness areas are Class 1 Federal Areas, under 40 CFR Part 81, where visibility is an important value and is not be impaired per 42 USC §7491). These wilderness areas should not be impacted due to the smoke management prescription parameters identified in, and implemented under, specific prescribed fire burn plans.

Carbon monoxide from a prescribed fire is rapidly diluted at short distances and therefore poses little or no health risk to the public. Firefighters are at the greatest health risk because they have longer exposures at higher concentrations. It is recommended that fireline personnel rotate away from the fireline periodically to decrease their exposure. By doing so, health impacts to firefighters could be mitigated.

Because the "No Action" alternative is defined as a wildfire situation, there are no specific recommended Standards and Guidelines and other mitigation measures identified. Each wildfire is unique and mitigation would be determined once the wildfire has been discovered and addressed by fire suppression resources.

Prescribed fires can produce some of the precursors to ozone, including nitrogen oxides (NO_x) and organic carbon. Ozone formation tends to be NO_x-limited and prescribed fires are usually not a major NO_x source when compared to other sources, such as vehicles. In addition, the

amount of NO_x and organic carbon coming from forestry activities is small compared to other sources. And most importantly, weather and climate conditions in this area tend to preclude prescribed fire from becoming a significant contributor to ozone formation. Most ozone events occur in mid-spring through late summer when hot temperatures and high-pressure air masses may stagnate over an area, and pollution is not dispersed. Prescribed fire is not typically conducted under these types of weather conditions because of the smoke dispersion issues. Emissions from prescribed fires are therefore unlikely to be a significant contributor to ozone.

Page 49

ALTERNATIVE 2 – PROPOSED ACTION

Analysis suggests that burning under prescribed fire prescriptions should not result in an exceedance of the NAAQS for any pollutant. Based on the location from the proposed project and prescribed wind directions for implementation of a prescribed fire, visibility would not likely be impacted at the Mingo Wilderness Area and Hercules Glades Wilderness Area Class 1 Federal Areas. Prescribed fire, by reducing fuel loading, may reduce emissions associated with any future wildfires in this area due to a reduction in available fuels.

Page 50

MONITORING

Air Quality

Monitoring Question: To what extent is forest management contributing or responding to air quality effects on ecosystems, human health, or human enjoyment?

Driver: Smoke Management, Standards and Guidelines, Prescribed Fire Burn Plan

Methods: Air quality (smoke) effects on human health and human enjoyment will be monitored by air quality monitors (Portable E-sampler) and or photographic documentation in designated sensitive areas as identified in prescribed fire burn plans to monitor smoke concentrations (micrograms per cubic meter) and or intensity. E-Sampler monitoring devices can tabulate what levels of smoke pollutants are being produced with real-time measurements of fine particulate matter concentrations (PM_{2.5}), air flow, air temperature, relative humidity, barometric pressure, wind speed, and wind direction. These kits can be used to monitor fine particulate matter emissions from wildfires and prescribed fire. If E-Sampler monitors are unavailable, agency staff can collect photographic documentation to record smoke conditions during prescribed fires.

Page 205

This Addendum reflects the review of the environmental assessment and specialist contributions of Claire O'Dea, Ph.D., Air Quality Specialist, USDA Forest Service, Eastern Region Office. The environmental assessment, Chapter 4, Consultation and Coordination, Preparers and Contributors, Technical Expertise, is appended with the addition of Claire O'Dea, Ph.D., Air Quality Specialist, USDA Forest Service, Eastern Region Office.

Page 207

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